is two-layered (overlaid by the epidermis), the inner layer differentiating as the tapetum; the stalk cell is represented only by a nucleus; the two male cells are equal, and occasionally three or four male cells derived from a single body cell were observed; four to ten archegonia are included in the single complex; the fusion nucleus becomes invested by the starch-filled cytoplasm of the male cell; at the first segmentation the male and female chromatin groups are still distinct.—J. M. C.

Respiration.—CZAPEK[30] gives an excellent summary of all work done on respiration of plants up to the present time. It is marked by conciseness and by emphasis on important points. One is surprised that the subject can be treated so thoroughly within the limits of twenty-five pages. The following topics are considered: definition and history, the amount and distribution of aerobic respiration in plants, physical and chemical factors capable of influencing respiration, postmortem carbon dioxid production and oxygen absorption, chemical materials of aerobic respiration, and the mechanism of vital oxidation (statement of our knowledge of respiratory enzymes). The literature considered involves 126 citations.

In discussing the materials used (oxidized) in aerobic respiration, CZAPEK mentions sugars and fats as the principal ones; but emphasizes the fact that in many bacteria (hydrogen, sulfur, nitrifying, etc.) the simplest inorganic substances are oxidized as a source of energy for carrying on life processes, while in many other cases the most complex proteins are split and finally oxidized for the same purpose. It is evident that this gives aerobic respiration a broad meaning. CZAPEK seems very much inclined to distinguish vital oxidations (*vitalen Verbrennungsprozess*) from other oxidations. Vital seems to mean more to him than merely a term to express the unknown.—WILLIAM CROCKER.

The fertile spike of Ophioglossaceae.—The nature of the so-called fertile spike of the Ophioglossaceae has been a prolific cause of discussion, culminating in the divergent views of BOWER and CAMPBELL. CHRYSLER[31] has now attacked the problem from the standpoint of vascular anatomy, examining all the genera, and has reached some important and apparently convincing conclusions.

The fertile spike is regarded as representing two fused leaflets or pinnae (basal pair) of a fern leaf. The proof is most obvious in *Botrychium virginianum*, in which each one of the pair of vascular bundles that supply the fertile spike leaves a gap in the trough-shaped leaf trace. This is sometimes less distinct in *B. ternatum* and *B. obliquum*, and certain other species show no trace of the gap; all of which are taken as indications of reduction. Abnormal specimens also confirm the view. The condition in Ophioglossum is considered to be derived

[30] CZAPEK, FR., Die Atmung der Pflanzen. Ergebnisse der Physiologie **9**:587–613. 1910.

[31] CHRYSLER, M. A., The nature of the fertile spike in the Ophioglossaceae. Annals of Botany **24**:1–18. *pls. 1, 2. figs. 16.* 1910.

from that found in Botrychium; while in Helminthostachys the fertile spike is interpreted as representing a single pinna. This would dispose of the sporangiophore nature of the spike, and revert to ROEPER'S view (in 1826) that it represents two fused basal pinnae.

The general conclusion is that the Ophioglossaceae are related to the ferns, and "have sprung from near the level of the Osmundaceae."—J. M. C.

The strobilus of Selaginella.—Miss GERTRUDE MITCHELL[32] has recorded some general studies of the strobilus of Selaginella, which fill up certain gaps in our knowledge, and "confirm or controvert statements" of other investigators.

In some species the axis was observed to renew its ordinary vegetative character beyond the strobilus: in one case abortive sporangia were produced in the axils of the foliage leaves just beyond the tip of the strobilus; in another species a second strobilus was produced upon such an axis, the two strobili being separated by a sterile region; and in still another case a branched strobilus was noted. The distribution of sporangia is variable, and species are enumerated under the following heads; one large basal megasporangium, several basal megasporangia succeeded by microsporangia, strobili wholly megasporangiate or microsporangiate, and an indiscriminate arrangement. The species are also enumerated that mature one, two, or three megaspores, instead of the more usual four, and also two rare cases in which there are twelve (*S. Vogelii*) and eight (*S. involvens*) megaspores. Considerable attention is given to the sporangium wall and its mechanism for dehiscence, involving what are spoken of as "its wonderful adaptations for cross-fertilization." The paper closes with a brief consideration of the vascular anatomy of the strobilus and the ligule.—J. M. C.

The stele of Osmunda.—The vascular anatomy of this genus has given rise to much discussion and to divergent opinions as to its phylogenetic significance. FAULL[33] has now investigated abundant material of the sporelings of *O. cinnamomea* in all stages, and has reached the following results and conclusions: The cortical cells at the base of the sporeling are inhabited by a fungus. While there is considerable variation in the development of different individuals, in no case is the transition from protostele to siphonostele effected by a simple expansion, as has been claimed for Osmundaceae. There are bays or gaps in the xylem near the nodes, which may result in inclosing a "stelar" pith. Rarely and only in adult stems does the internal endodermis and "extrastelar" pith connect with the external endodermis and cortex through leaf gaps. Internal phloem has been found in unbranched adult plants, and this fact, together with the absence of branching in the sporeling, is thought to indicate that internal phloem and

[32] MITCHELL, GERTRUDE, Contributions towards a knowledge of the anatomy of the genus *Selaginella* Spr. Part V. The strobilus. Annals of Botany **24**:19–34. *pls. 3, 4.* 1910.

[33] FAULL, J. H., The stele of *Osmunda cinnamomea.* Trans. Canadian Inst. **8**:515–534. *pls. 4–6.* 1909.